WIND AND PV POTENTIAL

R.A.Y. Federal Building, St. Louis, Missouri

Daniel F. Hellmuth, AIA, LEED™ Accredited Professional
Principal, Hellmuth + Bicknese Architects, L.L.C.

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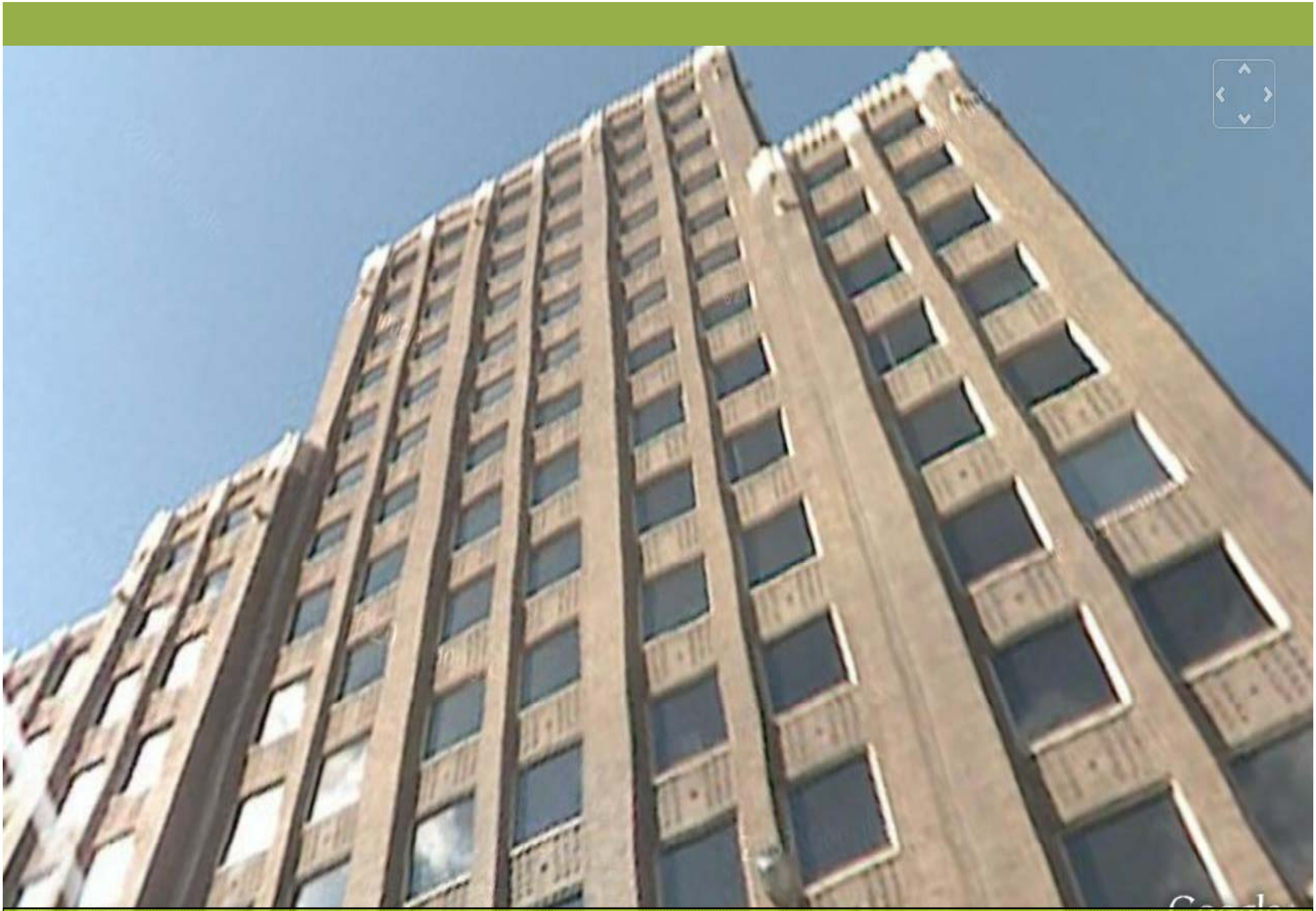

HISTORIC CONSIDERATIONS

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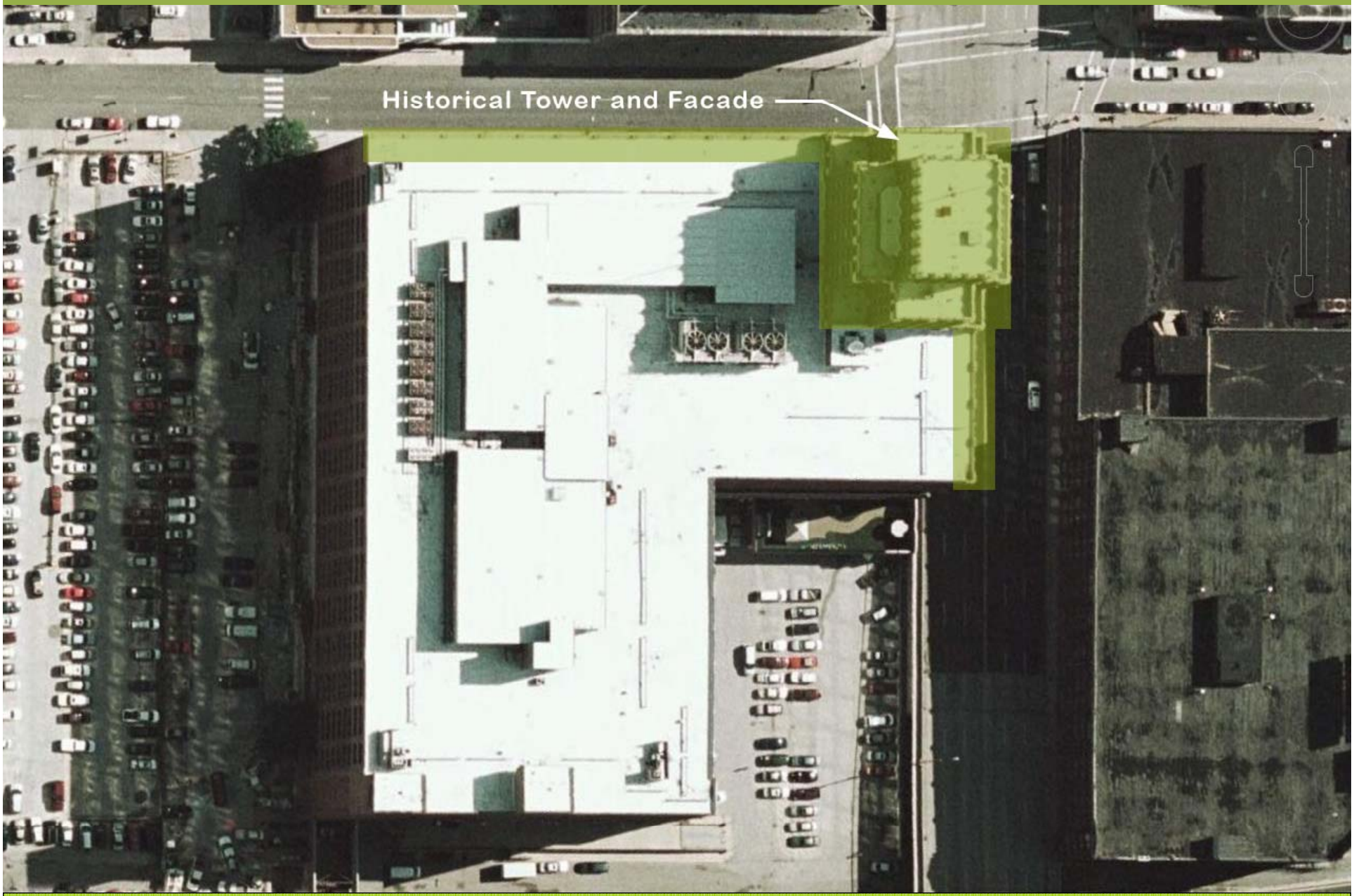

HISTORICAL TOWER AND FACADE

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EXISTING CONDITIONS

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OBSTRUCTIONS: TOWER ROOF

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OBSTRUCTIONS: ELEVATOR PENTHOUSE

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OBSTRUCTIONS: ELEVATOR PENTHOUSE

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OBSTRUCTIONS: ANCHORING SYSTEM

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OBSTRUCTIONS: ROOF UNIT

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OBSTRUCTIONS: HIGHWAY

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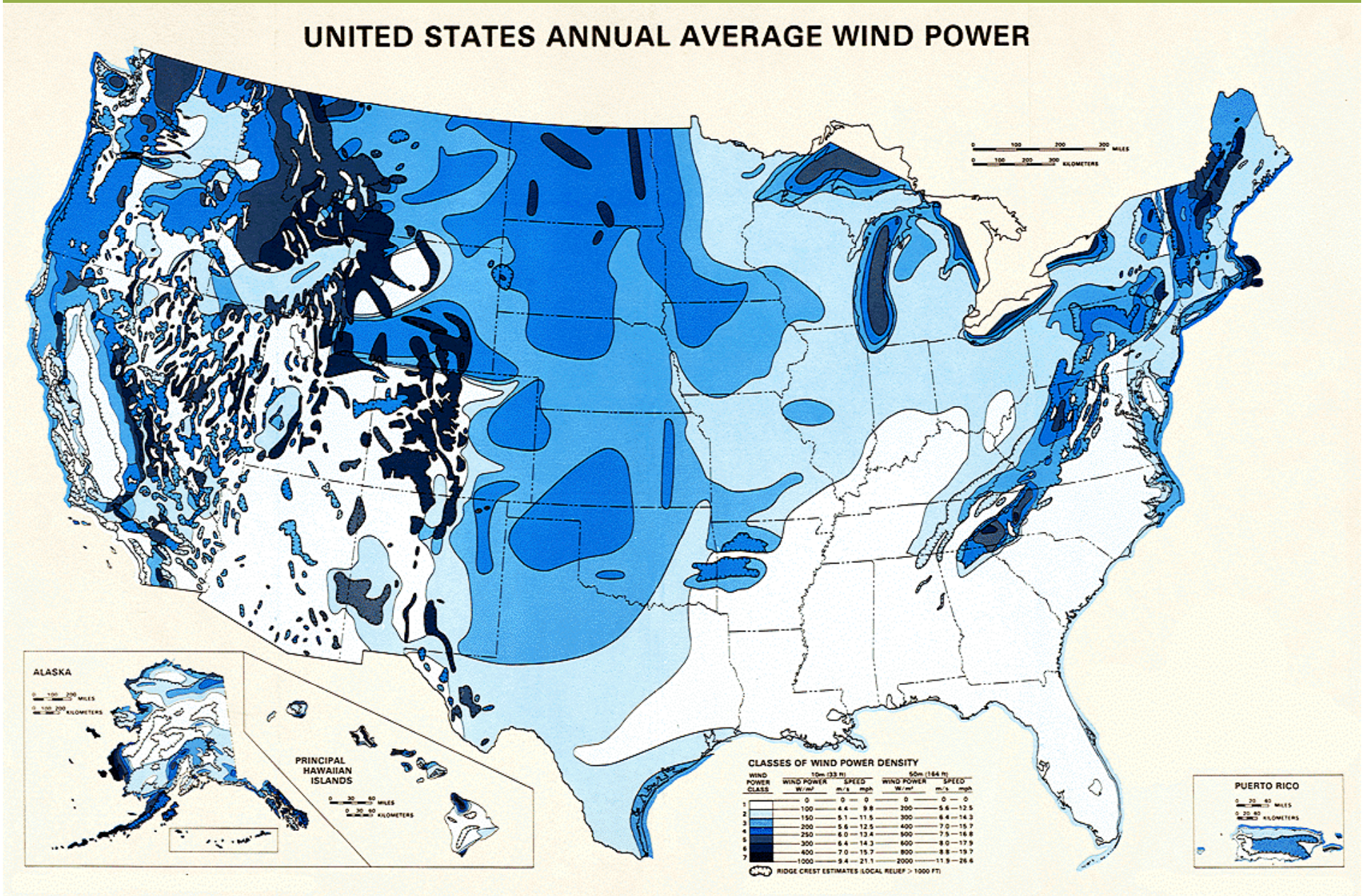
ADVANTAGES:

- WIND SPEED INCREASES WITH HEIGHT
- NO LARGE TOWER REQUIRED
- VISIBLE ENVIRONMENTAL SYMBOL

DISADVANTAGES:

- LIABILITY ISSUES
- TURBULENCE ISSUES
- LOW WIND SPEEDS IN OUR REGION
- HIGHER RELATIVE COST
- POTENTIAL VIBRATION ISSUES



WIND POWER POTENTIAL

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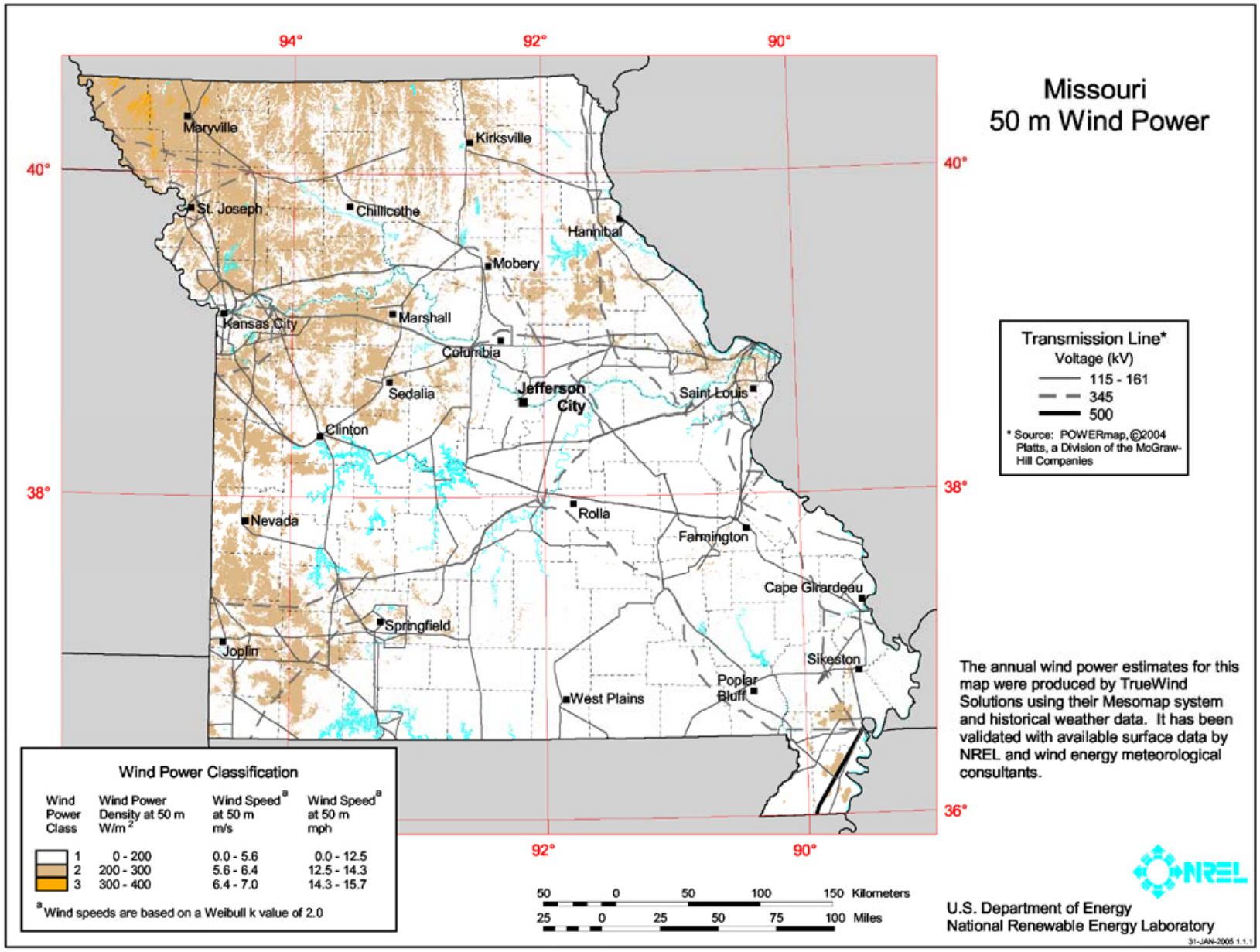

WIND POWER POTENTIAL

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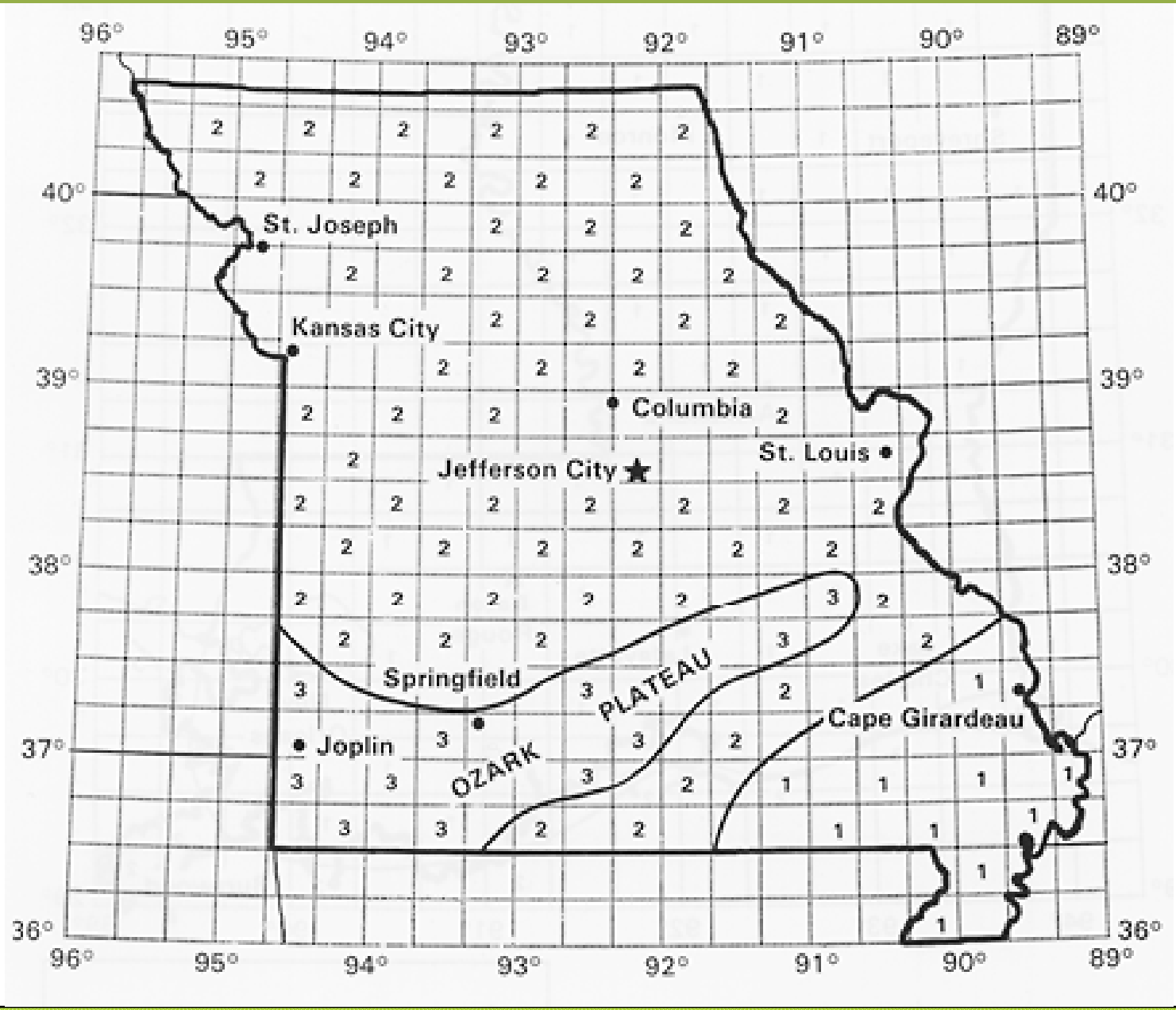

WIND POWER POTENTIAL

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WIND TURBINES : AEROVIRONMENT

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WIND TURBINE : WIND CUBE

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WIND TURBINE : SWIFT

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VERTICAL AXIS : SWIFT

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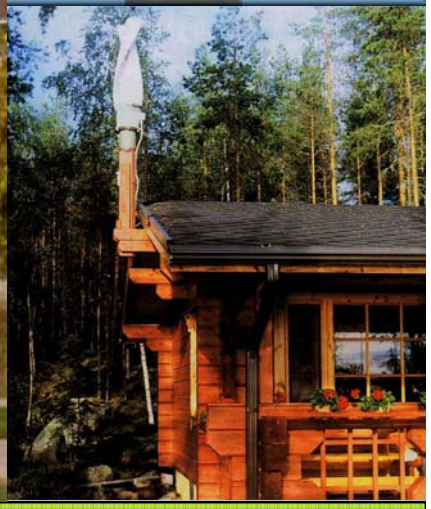

VERTICAL AXIS : WINDSIDE

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VERTICAL AXIS : MARIAH WINDSPIRE

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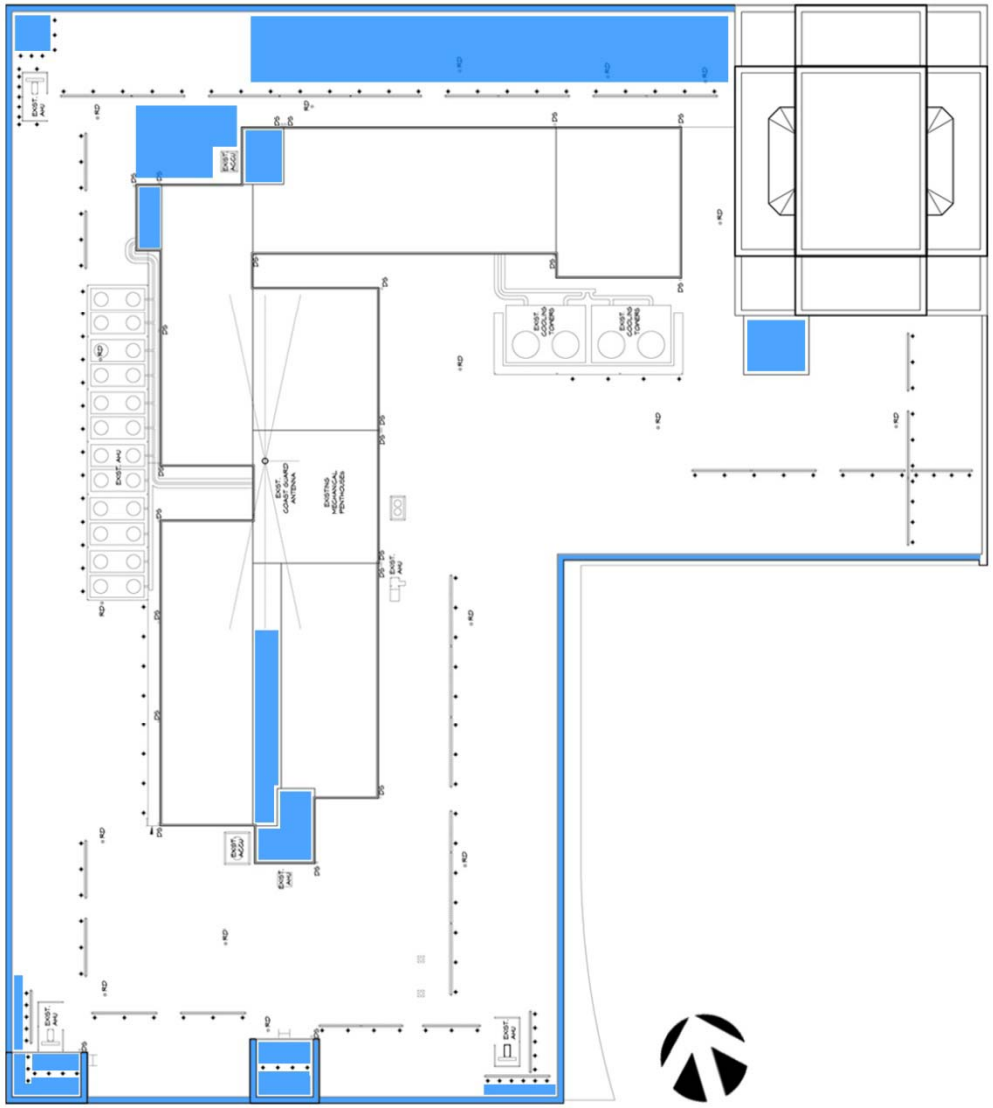

Wind Turbine Locations

Proposed Wind Turbine Roof Locations

WIND TURBINE ROOF LOCATIONS

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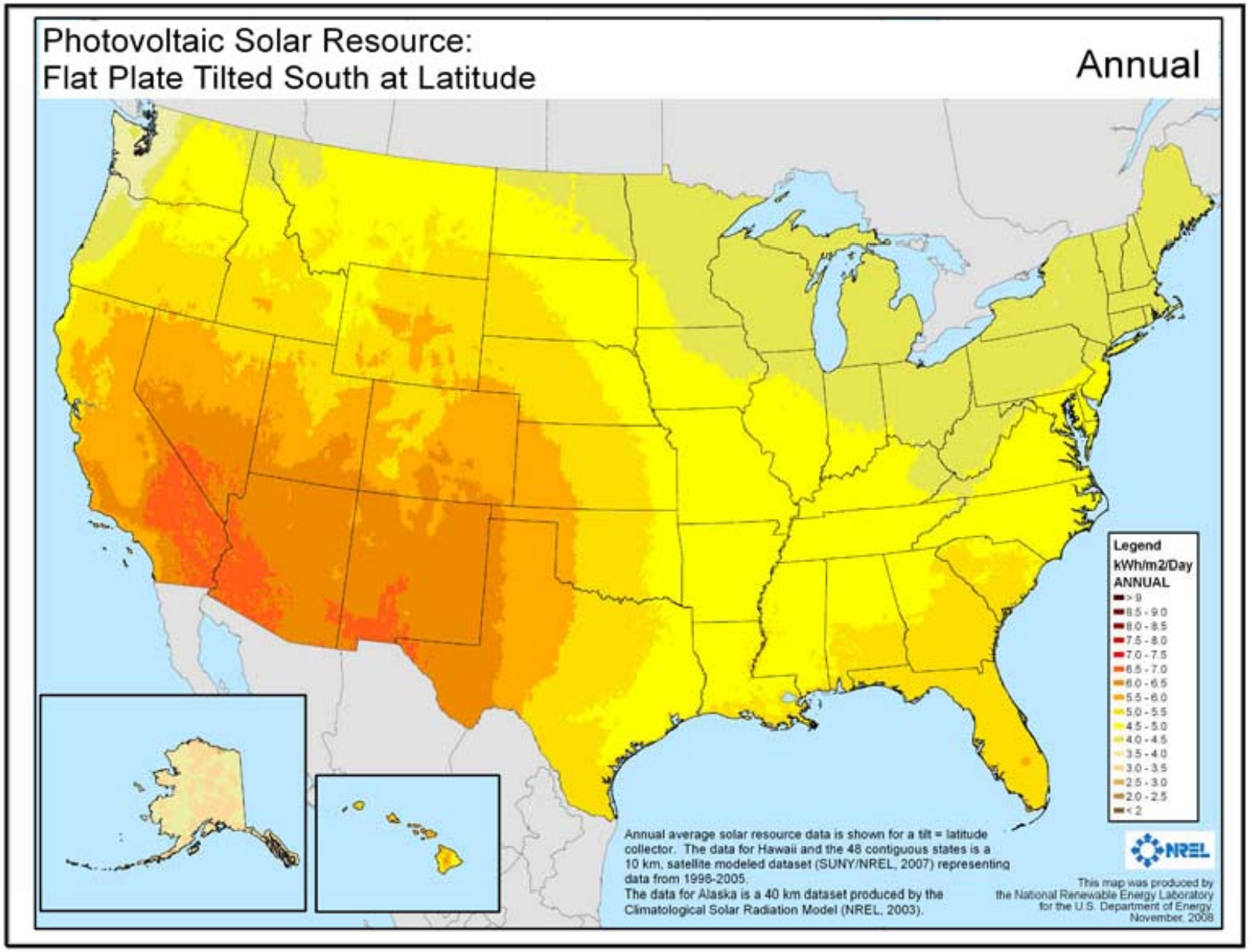
ADVANTAGES:

- GOOD SOLAR INSOLATION IN MISSOURI (AVERAGE FOR COUNTRY)
- LOWER COST PER kW THAN WIND
- CAN BE VISIBLE ENVIRONMENTAL SYMBOL

DISADVANTAGES:

- STILL RELATIVELY HIGH COST
- CAN BE DRAMATICALLY EFFECTED BY PARTIAL SHADING



PV POTENTIAL

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FLAT PANEL : EVERGREEN

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FLAT PANEL : EVERGREEN

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FLAT PANEL : EVERGREEN

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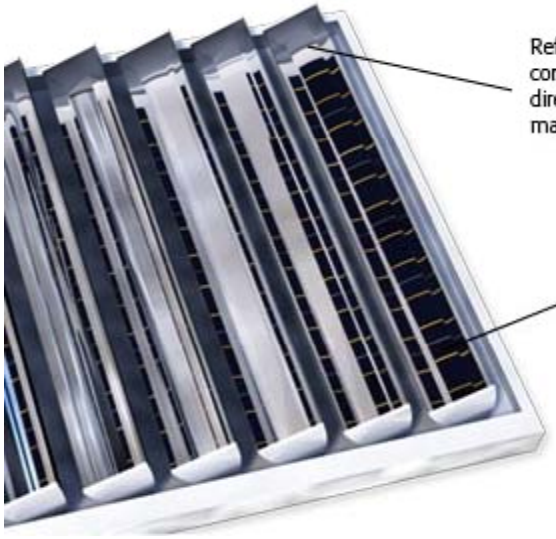

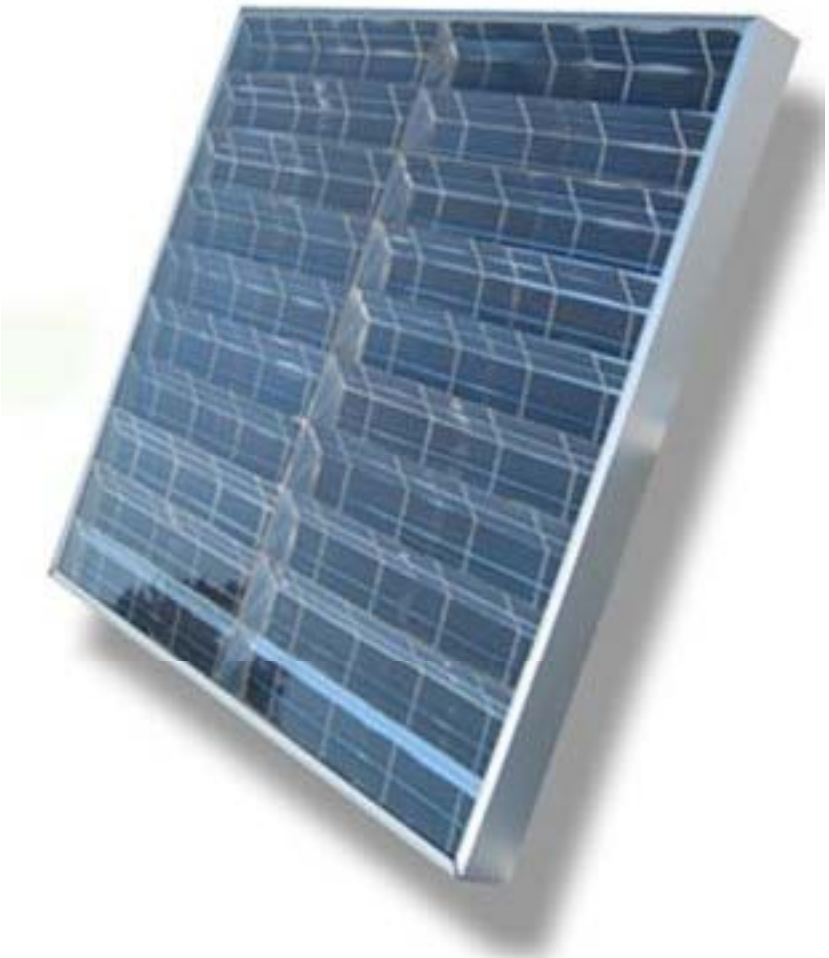

CONCENTRATING PV PANELS

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SOLAR THERMAL PANELS

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Photovoltaic Locations

Proposed Photovoltaic Panels in Unobstructed Roof Locations

Proposed Photovoltaic Panels in Partially Obstructed Roof Locations

PV ROOF LOCATIONS

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COMBINED PV & WIND : AEROTECTURE

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COMBINED PV & WIND : AEROTECTURE

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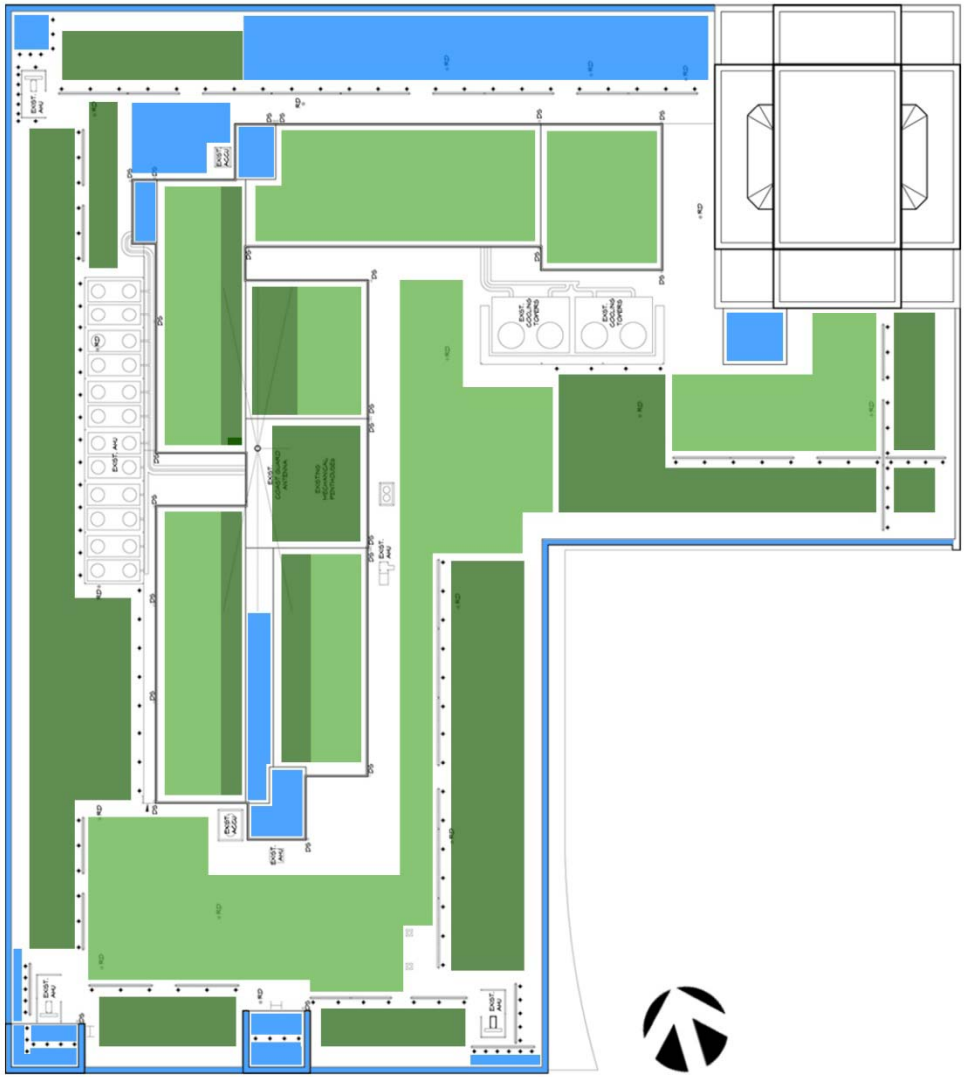

Photovoltaic & Wind Turbine Locations

Proposed Photovoltaic Panels in Unobstructed Roof Locations

Proposed Photovoltaic Panels in Partially Obstructed Roof Locations

Proposed Wind Turbine Roof Locations

COMBINED PV & WIND LOCATIONS

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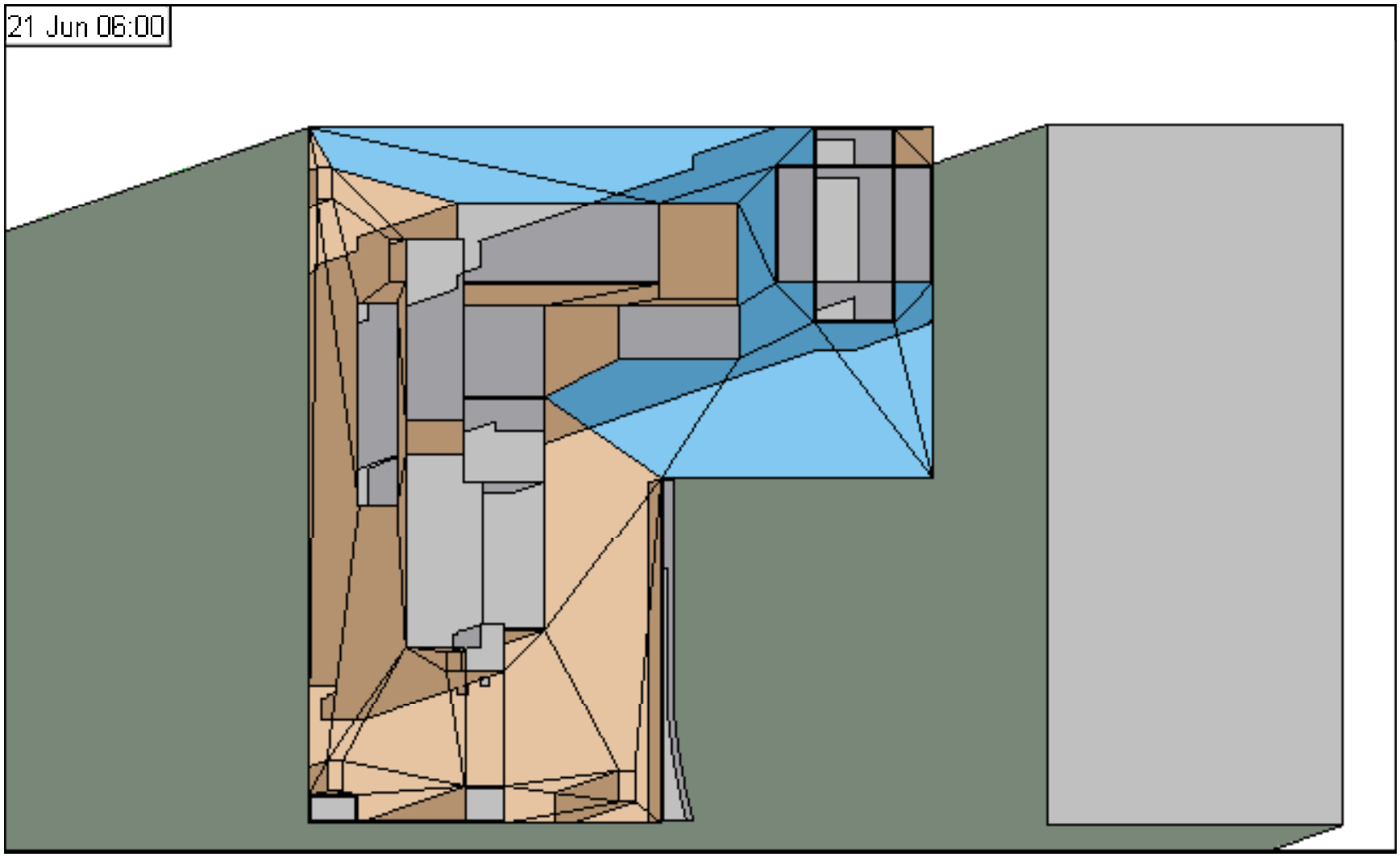

ROOF SUMMER SHADING STUDY

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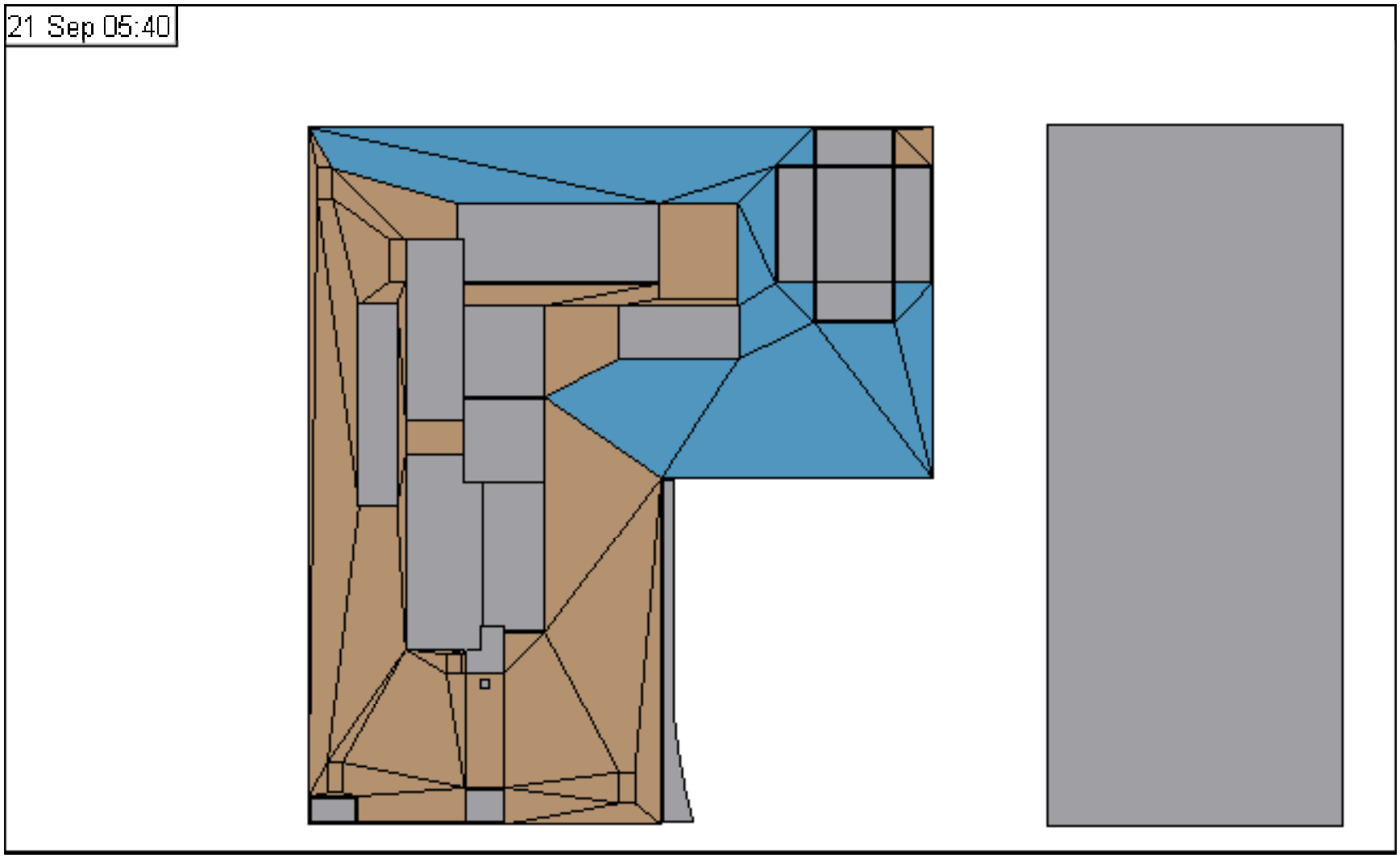

ROOF FALL SHADING STUDY

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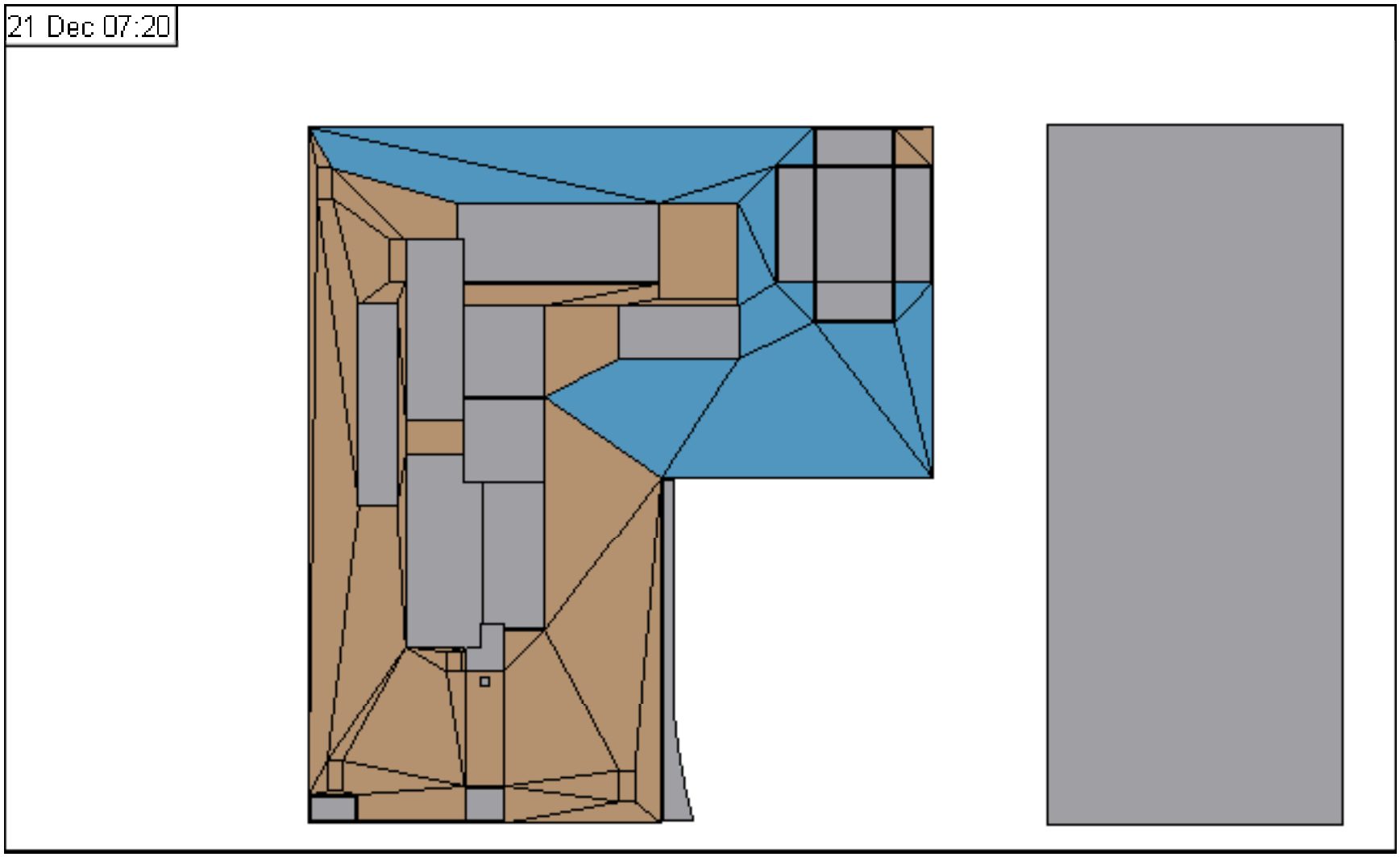

ROOF WINTER SHADING STUDY

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FAÇADE OPPORTUNITIES

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FIXED PV PANEL CANOPY

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TRACKING PV PANEL CANOPY

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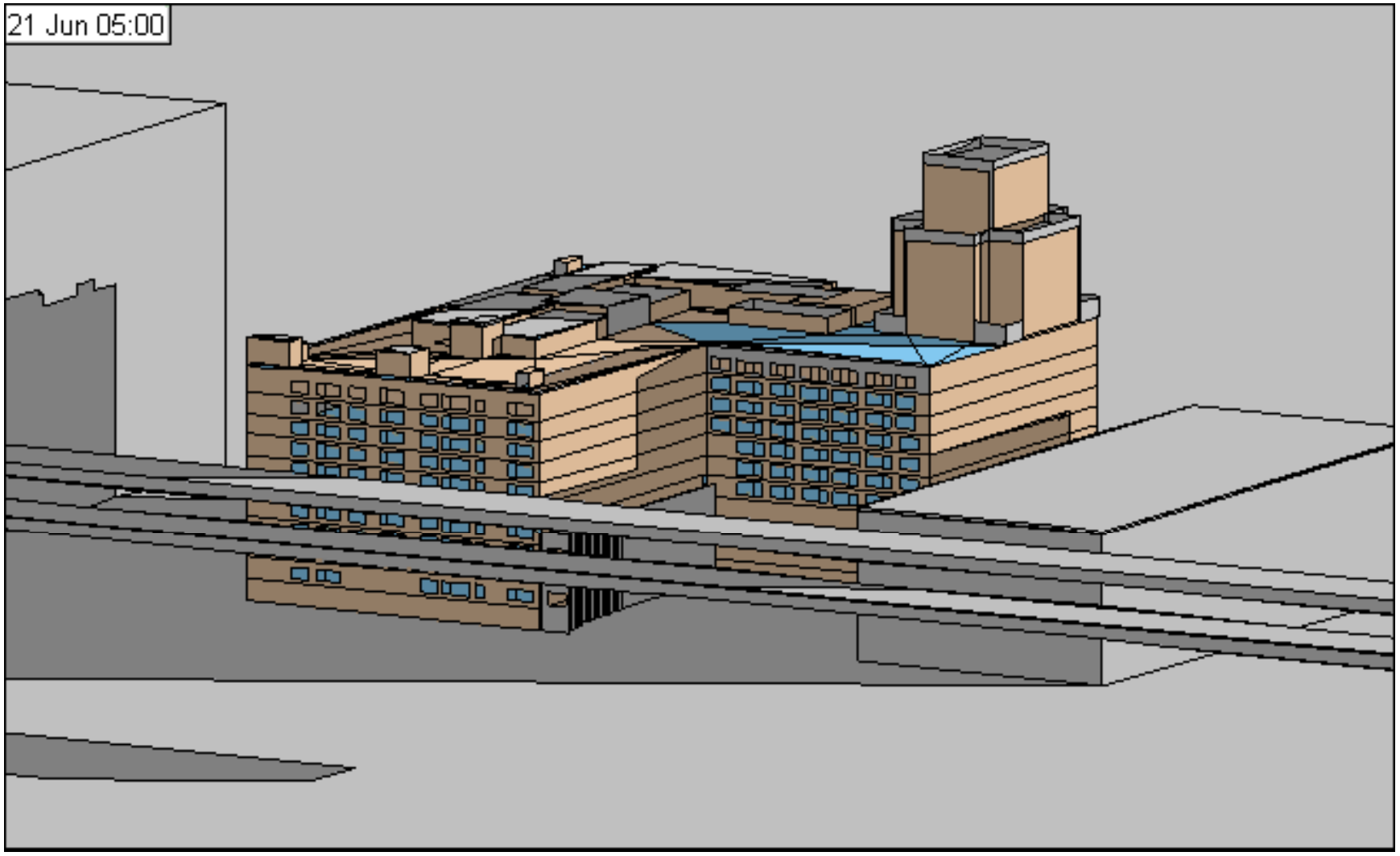

SOUTH FAÇADE SUMMER SHADING STUDY

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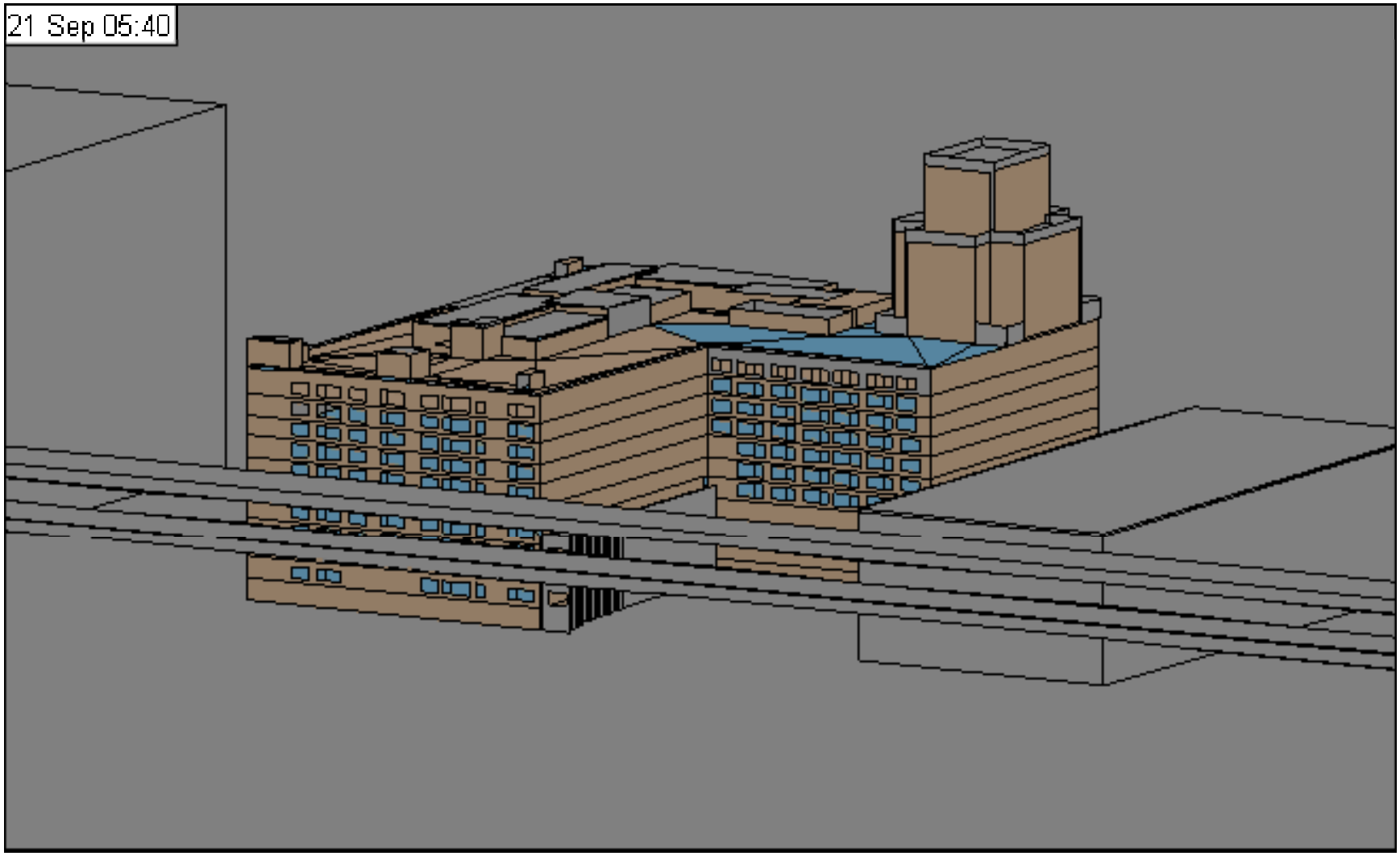

SOUTH FAÇADE FALL SHADING STUDY

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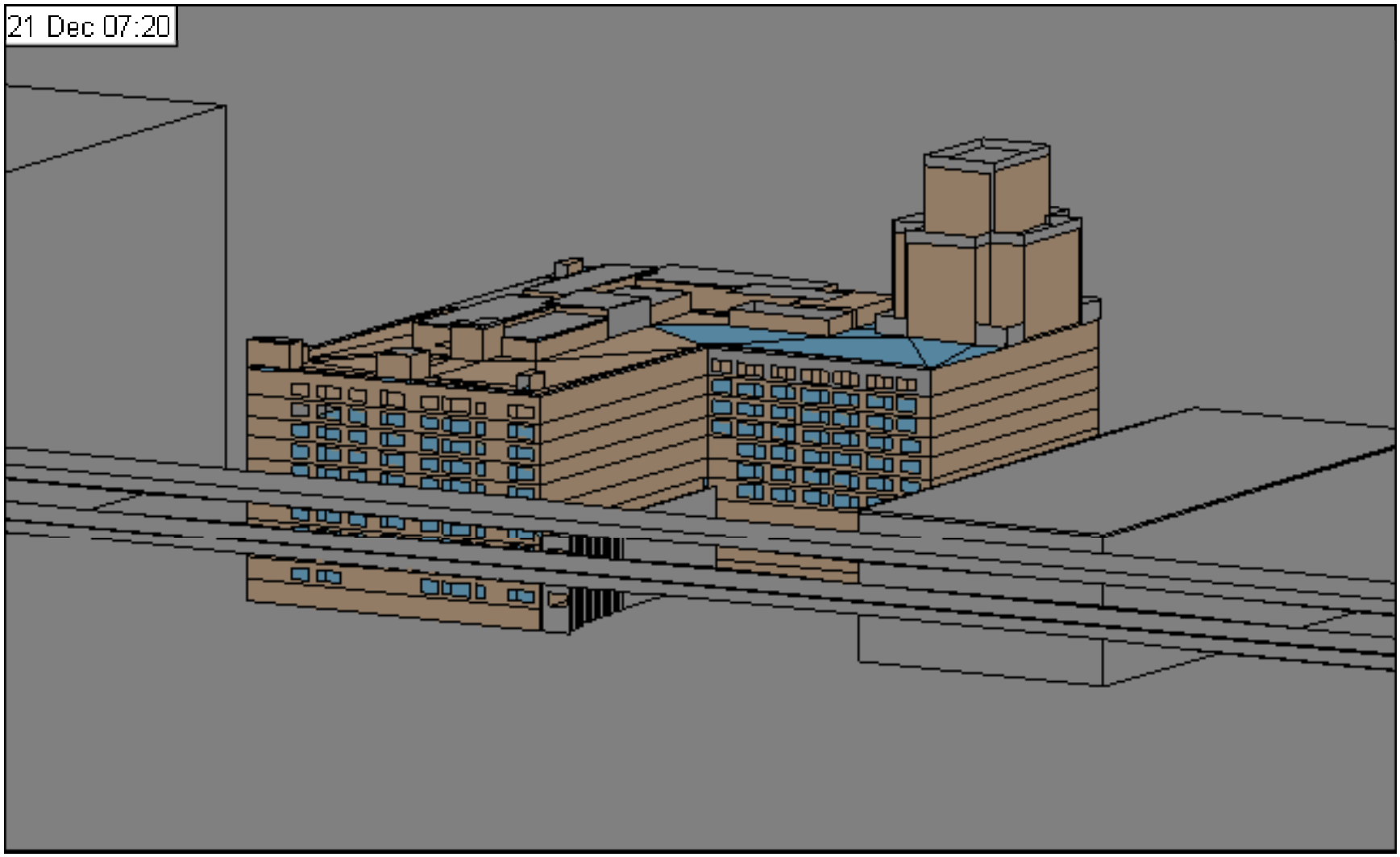

SOUTH FAÇADE WINTER SHADING STUDY

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PV PARKING CANOPY

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PV PARKING CANOPY

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PV PARKING CANOPY

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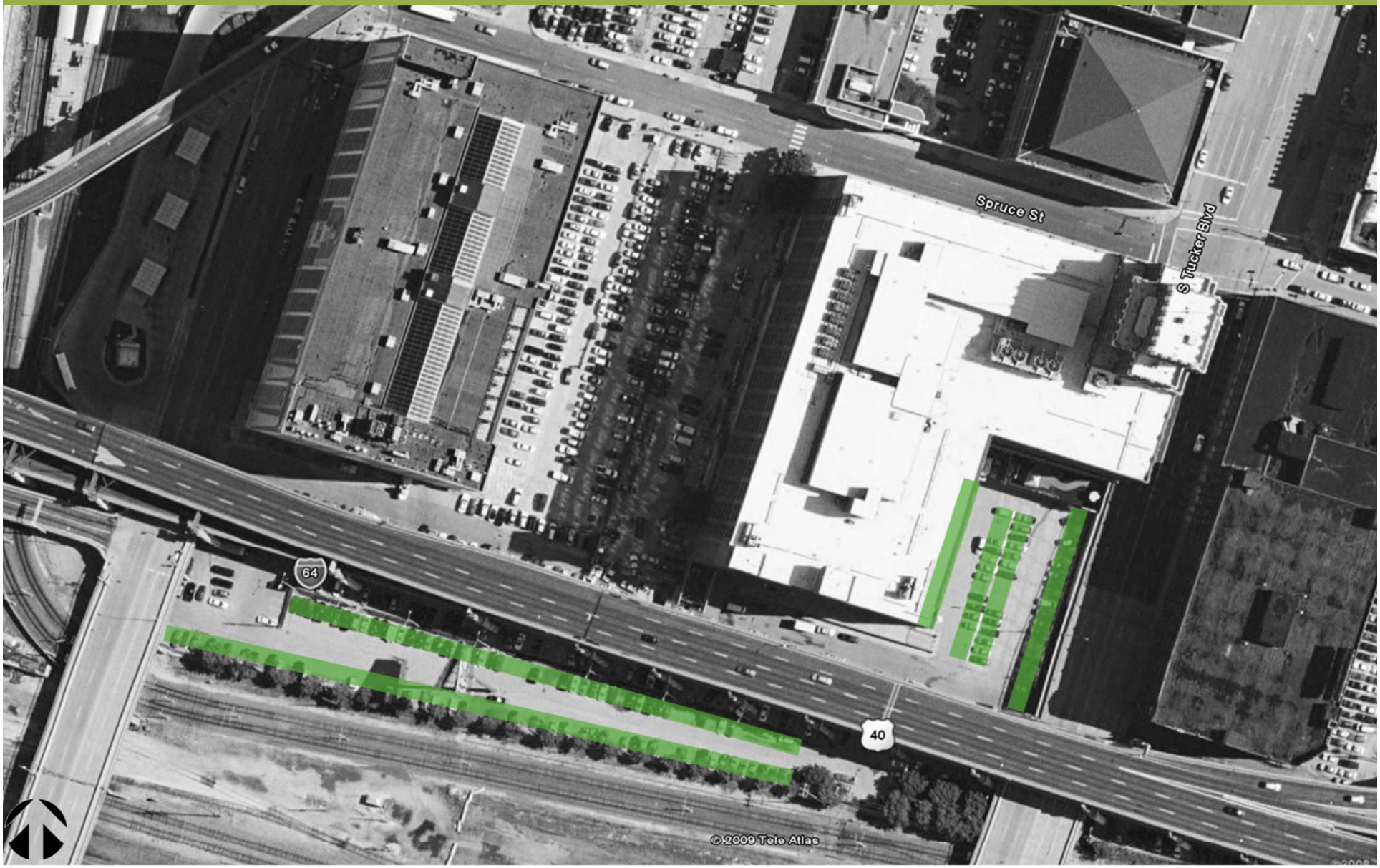

Proposed Photovoltaic Panel Parking Canopy Locations.

PV PARKING CANOPY LOCATIONS

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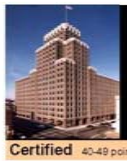
EXACT COST VARY

- PROJECT LOCATION
- NUMBER OF TURBINES AND/OR PANELS PURCHASED
- REQUIRED MOUNTING METHOD

- GENERALLY THREE FACTORS AFFECT PAYBACK PERIOD
  - AVERAGE WIND SPEED AT HUB HEIGHT OR SOLAR ACCESS
  - ELECTRIC RATE
  - REBATES AND INCENTIVES

- INCENTIVES
  - 30% FEDERAL TAX CREDIT
  - AMEREN UE'S PURE POWER (1.5 CENT PER kWh RENEWABLE ENERGY CREDIT)



Robert A. Young Federal Building

1222 Spruce Street St. Louis, Missouri

LEED NC Version 3 Project Checklist

Date: 08.28.2009
Project No.: 09008

Certified 40-49 points Silver 50-69 points Gold 60-79 points Platinum 80 points and above Possible Points 110

13	5	6	Sustainable Sites	Possible Points	26
Y	?	N			
	?		Prereq 1	Construction Activity Pollution Prevention	0
1			Credit 1	Site Selection	1
5			Credit 2	Development Density & Community Connectivity	5
		1	Credit 3	Brownfield Redevelopment	1
4			Credit 4.1	Alternative Transportation, Public Transportation Access	6
	1		Credit 4.2	Alternative Transportation, Bicycle Storage & Changing Rooms	1
	3		Credit 4.3	Alternative Transportation, Low-Emitting and Fuel-Efficient Vehicles	3
2			Credit 4.4	Alternative Transportation, Parking Capacity	2
		1	Credit 5.1	Site Development, Protect or Restore Habitat	1
		1	Credit 5.2	Site Development, Maximize Open Space	1
		1	Credit 6.1	Stormwater Design, Quantity Control	1
		1	Credit 6.2	Stormwater Design, Quality Control	1
		1	Credit 7.1	Heat Island Effect, Non-Roof	1
1			Credit 7.2	Heat Island Effect, Roof	1
	1		Credit 8	Light Pollution Reduction	1

0	8	2	Water Efficien		
Y	?	N			
	?		Prereq 1	Wate	
	2		Credit 1.1	Wate	
	2		Credit 1.2	Wate	
		2	Credit 2	Innov	
	2		Credit 3.1	Wate	
	1		Credit 3.2	Wate	
	1		Credit 3.3	Wate	

3	32	0	Energy & Atm		
Y	?	N			
	?		Prereq 1	Func	
	?		Prereq 2	Mini	
	?		Prereq 3	Func	
	1		Credit 1.1	Optim	
	1		Credit 1.2	Optim	
	1		Credit 1.3	Optim	
	1		Credit 1.4	Optim	
	1		Credit 1.5	Optim	
	1		Credit 1.6	Optimize Energy Performance, 22% New / 18% Existing*	1
	1		Credit 1.7	Optimize Energy Performance, 24% New / 20% Existing*	1
	1		Credit 1.8	Optimize Energy Performance, 26% New / 22% Existing	1
	1		Credit 1.9	Optimize Energy Performance, 28% New / 24% Existing	1
	1		Credit 1.10	Optimize Energy Performance, 30% New / 26% Existing	1
	1		Credit 1.11	Optimize Energy Performance, 32% New / 28% Existing	1
	1		Credit 1.12	Optimize Energy Performance, 34% New / 30% Existing	1
	7		Credit 1.13-1.19	Optimize Energy Performance, 36-48% New / 32-44% Existing	7
	1		Credit 2.1	On-Site Renewable Energy, 1%	1
	1		Credit 2.2	On-Site Renewable Energy, 3%	1
	1		Credit 2.3	On-Site Renewable Energy, 5%	1
	1		Credit 2.4	On-Site Renewable Energy, 7%	1
	1		Credit 2.5	On-Site Renewable Energy, 9%	1
	1		Credit 2.6	On-Site Renewable Energy, 11%	1
	1		Credit 2.7	On-Site Renewable Energy, 13%	1
	2		Credit 3	Enhanced Commissioning	2
	2		Credit 4	Enhanced Refrigerant Management	2
3			Credit 5	Measurement & Verification	3
	2		Credit 6	Green Power	2

* in increments of 3.5%

16	45	8	SUBTOTAL	16

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Energy & Atmosphere — Possible Points

Credit 2.1	**On-Site Renewable Energy**, 1%	
Credit 2.2	**On-Site Renewable Energy**, 3%	
Credit 2.3	**On-Site Renewable Energy**, 5%	
Credit 2.4	**On-Site Renewable Energy**, 7%	
Credit 2.5	**On-Site Renewable Energy**, 9%	
Credit 2.6	**On-Site Renewable Energy**, 11%	
Credit 2.7	**On-Site Renewable Energy**, 13%	

*** Up to 8 Potential Points under LEED NCv3**

Robert A. Young Federal Building

1222 Spruce Street St. Louis, Missouri

LEED NC Version 3 Project Checklist

Score 31

Date: 08.28.2009
Project No: 09008

Certified 40-49 points Silver 50-69 points Gold 60-79 points Platinum 60 points and above

8	4	2	Materials & Resources	Possible Points	14
Y	?	N			
Y			Prereq 1	Storage & Collection of Recyclables	0
1			Credit 1.1	Building Reuse, Maintain 55% of Existing Walls, Floors & Roof	1
1			Credit 1.1	Building Reuse, Maintain 75% of Existing Walls, Floors & Roof	1
1			Credit 1.1	Building Reuse, Maintain 95% of Existing Walls, Floors & Roof	1
1			Credit 1.2	Building Reuse, Maintain 50% of Interior Non-Structural Elements	1
1			Credit 2.1	Construction Waste Management, Divert 50% from Disposal	1
1			Credit 2.2	Construction Waste Management, Divert 75% from Disposal	1
		1	Credit 3.1	Materials Reuse, Specify 5%	1
					1
					1
					1
				factured Regionally	1
				factured Regionally	1
					1
					1

Possible Points 15

	0
	0
	1
	1
	1
	1
	1
	1
	1
ts	1
	1
	1
	1
	1
	1

		1	Credit 8.1	Daylight & Views, Daylight 75% of Spaces	1
		1	Credit 8.2	Daylight & Views, Views for 90% of Spaces	1

2	4	0	Innovation & Design Process	Possible Points	6
Y	?	N			
1			Credit 1.1	Innovation in Design: Green Cleaning	1
	1		Credit 1.2	Innovation in Design: Education Program	1
	1		Credit 1.3	Innovation in Design:	1
	1		Credit 1.4	Innovation in Design:	1
	1		Credit 1.5	Innovation in Design:	1
1			Credit 2	LEED™ Accredited Professional	1

1	3	0	Regional Priority	Possible Points	4
Y	?	N			
1			Credit 1.1	Regional Priority	1
	1		Credit 1.2	Regional Priority	1
	1		Credit 1.3	Regional Priority	1
	1		Credit 1.4	Regional Priority	1

15	20	4	SUBTOTAL	31
31			TOTAL	31
TOTAL POINTS				

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LEED **EAc2 ON SITE** RENEWABLE ENERGY

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